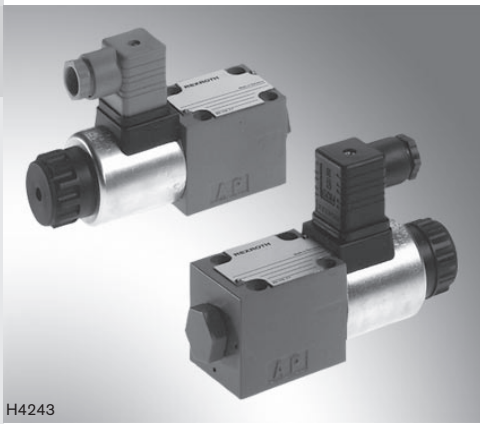
2/2, 3/2 and 4/2 directional poppet valve with solenoid actuation

RE 22049/07.06 1/14
Replaces: 06.06

Type M-.SED



NG 6
Component series 1X
Maximum operating pressure 350 bar *[5100 psi]*
Maximum flow 25 l/min *[6.6 gpm]*

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Direct operated directional poppet valve with solenoid actuation
- Port pattern as per DIN 24340 form A NG6 (without locating bore)
- Port pattern as per ISO 4401-03-02-0-94, NFPA T3.5.1 MR1 and ANSI B93-7 D03 (with locating bore/anti-rotation pin)
- Safe operation even after long idle periods or standstill under pressure
- Wet-pin DC solenoids with removeable coil (AC voltage possible by means of rectifier plug)
- Solenoid coil can be rotated 90°
- Pressure-tight chamber need not be opened for coil replacement
- Individual electrical connection
- With concealed manual override, optional
- Inductive position indicator (contact-free), optional, see RE 24830.

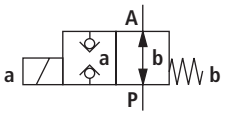
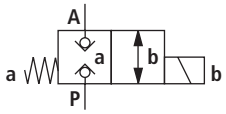
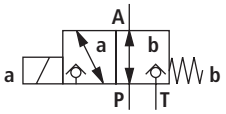
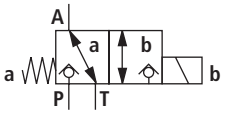
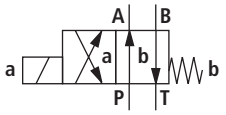
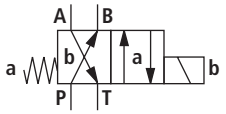
Order code

M–	SED	6	–1X/350	C		

2 main ports = **2**
3 main ports = **3**
4 main ports = **4**

Poppet valve

NG6, ISO4401-3, NFPA/ANSI D03 Interface = **6**

Main ports	2	3	4	
Symbols 	●	–	–	= **PK**
	●	–	–	= **NK**
	–	●	–	= **UK**
	–	●	–	= **CK**
	–	–	●	= **D**
	–	–	●	= **Y**
	● = available			

Component series 10 to 19 = **1X**
(10 to 19: Unchanged installation and connection dimensions)

Operating pressure 350 bar *[5,100 psi]* = **350**

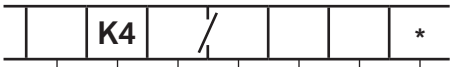
Wet-pin solenoid (in oil immersed) with removeable coil = **C**

24 V DC = **G24**
205 V DC = **G205** [1)]
96 V DC = **G96**

For further order codes for other voltages, see page 6

AC electricity supply system (permissible voltage tolerance ± 10%)	**Nominal voltage of the DC solenoid when operated with rectified AC voltage**	**Order code**
110 V - 50/60 Hz	96 V	**G96**
120 V - 60 Hz	110 V	**G110**
230 V - 50/60 Hz	205 V	**G205**

For standard types, see page 3.



Further details in clear text

No code = **Without** locating bore
/62 = **With** locating bore and anti-rotation pin ISO 8752-3x8-St

No code = NBR seals
V = FKM seals
(other seals upon request)
⚠ Caution!
Observe compatibility of seals with hydraulic fluid used!

No code = Without check valve insert, without throttle orifice insert
P = With check valve insert
B12 = Throttle Ø1.2 mm *[0.047"]*
B15 = Throttle Ø1.5 mm *[0.059"]*
B18 = Throttle Ø1.8 mm *[0.071"]*
B20 = Throttle Ø2.0 mm *[0.079"]*
B22 = Throttle Ø2.2 mm *[0.087"]*
Other orifices upon request

Accessories
Inductive position indicator, see RE 24830

No code = Without indicator
QMAG24 = Indicator monitors position **a**
QMBG24 = Indicator monitors position **b**

Electrical connection

K4 [2] **=** **Without** mating connector with connector as per DIN EN 175301-803

N9 = **With** concealed manual override
No code = **Without** hand override

[1] When connecting to an AC voltage a DC solenoid and a AC rectifier must be used (see table page 2).
For individual connections a large mating connector with integrated rectifier can be used (order separately, see page 13).

[2] Mating connectors, order separately, see page 13.

Standard types

Type	Material number
M-3SED 6 UK1X/350CG24N9K4	R900052621
M-3SED 6 UK1X/350CG96N9K4	R900207848

Type	Material number
M-3SED 6 CK1X/350CG24N9K4	R900052392
M-3SED 6 CK1X/350CG96N9K4	R900218734

For additional standard types and components please contact Product Support.

Function, cross-section, symbols: 2/2 and 3/2 directional poppet valve

General:

Directional valves of type M-.SED are direct operated directional poppet valves with solenoid actuation. They control the start, stop and direction of a flow. They consist of a housing (1), solenoid (2), valve seats (7) and (11) and closing element (4).

With the help of manual override (6) the valve can be actuated without energizing the solenoid.

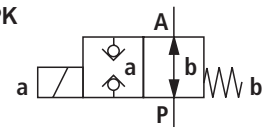
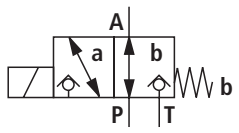
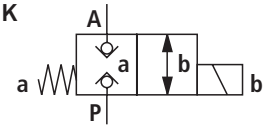
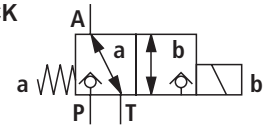
Function (3/2 directional poppet valve)**:**

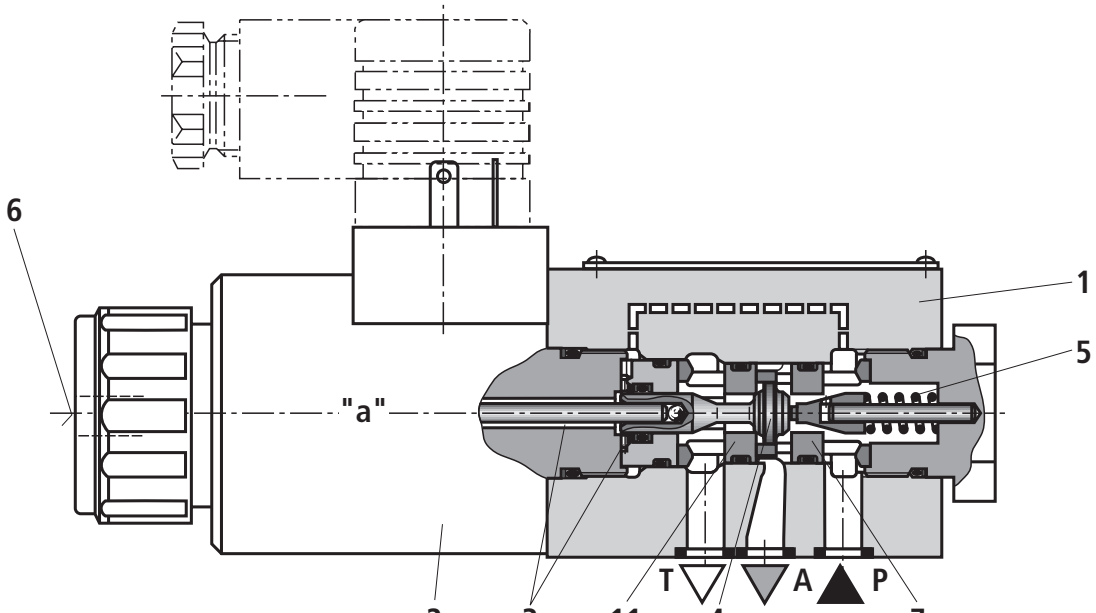
The valve´s de-energized position (normally open **UK** or normally closed **CK**) is determined by the arrangement of spring (5). Chamber (3) behind closing element (4) is connected to port P and blocked from port T. The valve is therefore pressure-balanced with regard to the actuating forces (solenoid and spring).

The closing element´s (4) special design allows ports P, A and T to be pressurised to the maximum operating pressure (350 bar *[5100 psi]*), and also allows flow to travel in either direction (see symbols)!

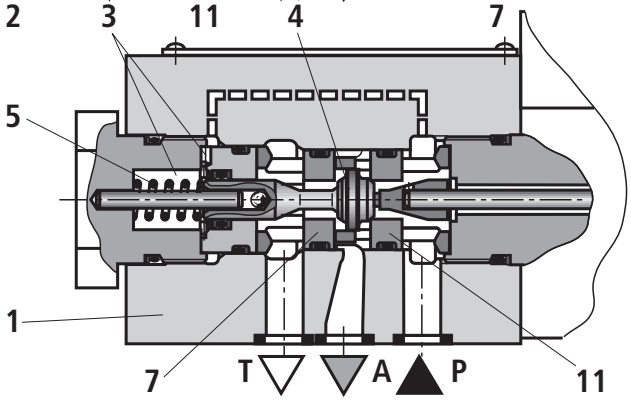
In the de-energized position, closing element (4) is pressed by spring (5) onto seat (11), in the energized position, it is pushed by solenoid (2) onto seat (7). the flow is blocked.

On the 2/2 directional poppet valve, the tank port is blocked internally.

2/2 directional poppet valve	3/2 directional poppet valve
PK 	**UK** 
NK 	**CK** 



Type M-3SED 6 UK1X/350CG24N9K4



Type M-3SED 6 CK1X/350CG24N9K4

Function, cross-section, symbols, schematic illustration: 4/2 directional poppet valve

In combination with a sandwich plate, called a „**Plus-1 plate**“, under the 3/2 directional poppet valve, this valve can then be used as a 4/2 directional poppet valve.

Function of the Plus-1 plate:

– De-energized position:
The main valve is not actuated. The spring (5) holds closing element (4) on seat (11). Port P is blocked, and port A is connected to Tank. A pilot line is provided from A to the bore side area of pilot spool (8), thereby unloading it to tank thru A. The pressure applied via P will hold ball (9) onto seat (10). Thus allowing P to be connected to B and A connected to T.

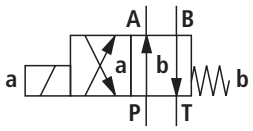
– Transition position:
When the main valve is actuated, closing element (4) is shifted against spring (5) and pressed onto seat (10). This results in the closure of port T, while P, A and B are briefly connected.

– Energized position:
P is connected to A. Since the pump pressure acts via A on the large area of pilot spool (8), ball (9) is pressed onto seat (12). Thus, B is therefore connected to T, and P to A. Ball (9) in the Plus-1 plate has a "positive switching overlap".

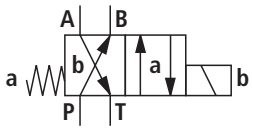
⚠ Caution!
In order to prevent pressure intensification when single-rod cylinders are used, the annulus area of the cylinder must be connected to A.

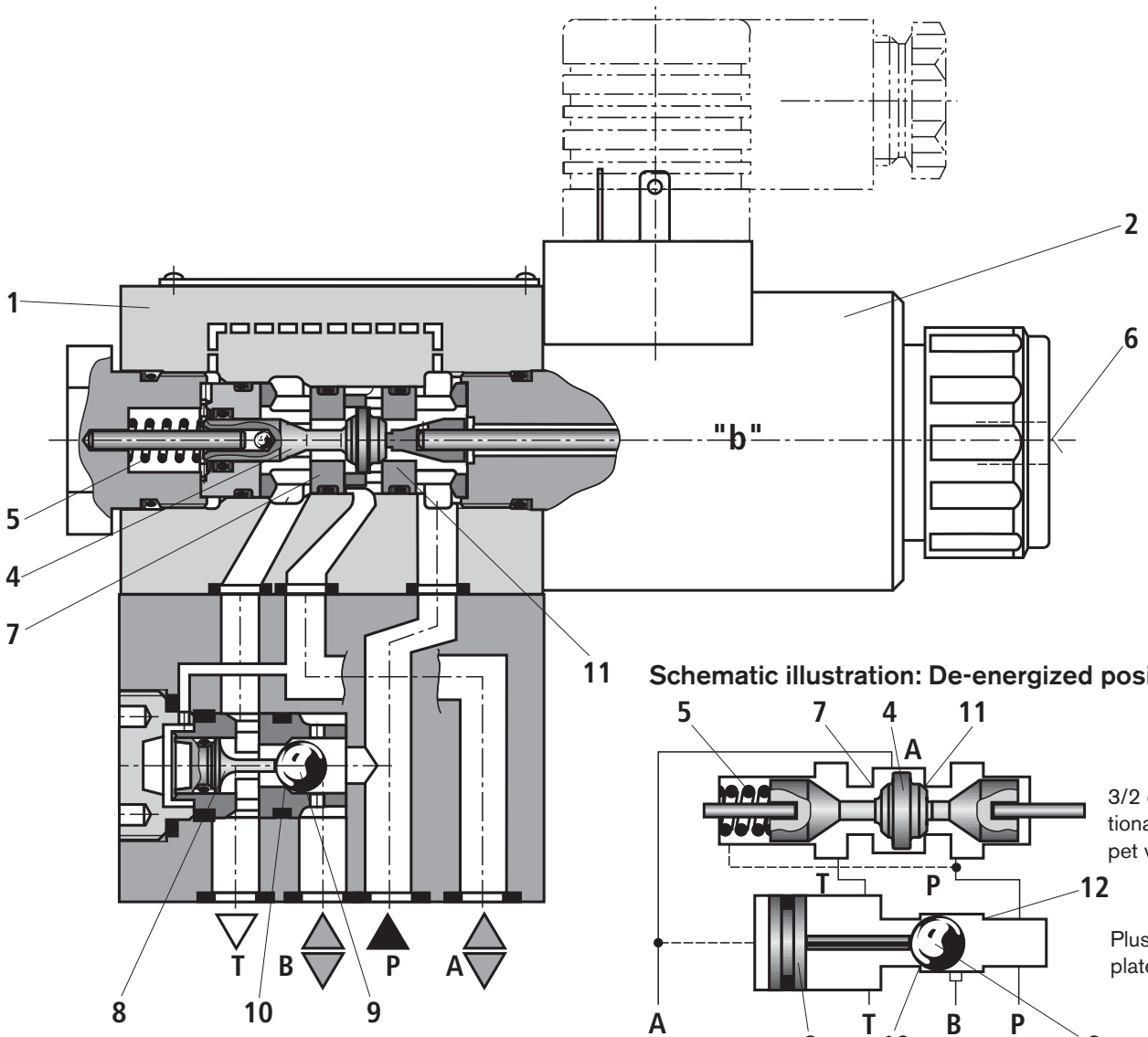
The use of the Plus-1 plate allows the following configurations:

Symbol D:



Symbol Y:





Type M-4SED 6 Y1X/350CG24N9K4

Schematic illustration: De-energized position

Technical data (for applications exceeding these parameters, please consult product support!)

General

Weight	– 2/2 directional poppet valve	kg *[lbs]*	1.5 *[3.3]*
	– 3/2 directional poppet valve	kg *[lbs]*	1.5 *[3.3]*
	– 4/2 directional poppet valve	kg *[lbs]*	2.3 *[5.1]*
Installation orientation			Unrestricted
Ambient temperature range		°C *[°F]*	–30 to +50 *[–22 to +122]* (NBR seals) –20 to +50 *[–4 to +122]* (FKM seals)

Hydraulic

Maximum operating pressure	bar *[psi]*	see table on page 8
Maximum flow	l/min *[gpm]*	25 *[6.6]*
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524 [1]; fast bio-degradable hydraulic fluids to VDMA 24568 (see also RE 90221); HETG (rape seed oil) [1]; HEPG (polyglycols) [2]; HEES (synthetic esters) [2]; other hydraulic fluids on enquiry
Hydraulic fluid temperature range	°C *[°F]*	–30 to +80 *[–22 to +176]* (NBR seals) –20 to +80 *[–4 to +176]* (FKM seals)
Viscosity range	mm^2/s *[SUS]*	2.8 to 500 *[35 to 2320]*
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)		Class 20/18/15 [3]

Electrical

Voltage type			DC	AC
Available voltages [4]		V	12, **24**, 42, 96, 110, 205, 220	Possible only in conjunction with rectifier (see page 13)
Voltage tolerance (nominal voltage)		%	±10	
Power consumption		W	30	
Duty cycle		%	100	
Switching time (as per ISO 6403)	– ON	ms	40 to 70	
	– OFF	ms	10 to 20 (without rectifier) 30 to 45 (with rectifier)	
Maximum switching frequency		1/h	15000	
Type of protection (as per DIN EN 60529)			IP 65 with mating connector mounted and secured	
Maximum coil temperature [5]		°C *[°F]*	150 *[302]*	

[1] Suitable for NBR **and** FKM seals

[2] Suitable **only** for FKM seals

[3] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

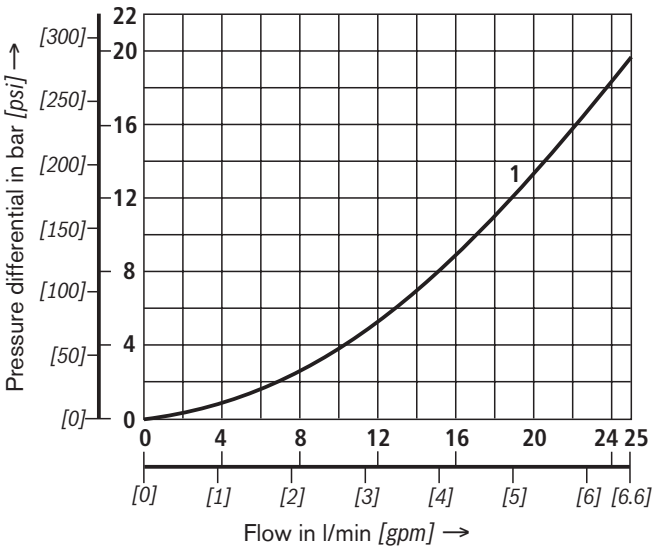
[4] Special voltages upon request

[5] Due to the surface temperatures of solenoid coils, observe European standards EN563 and EN982!

When making the electrical connection, properly connect the ground conductor (PE ⏚).

Characteristic curves (measured with HLP46, $\vartheta_{oil\ (\nu = 190\ SUS)}$ = 40 °C ± 5 °C *[104 °F ± 9 °F]*)

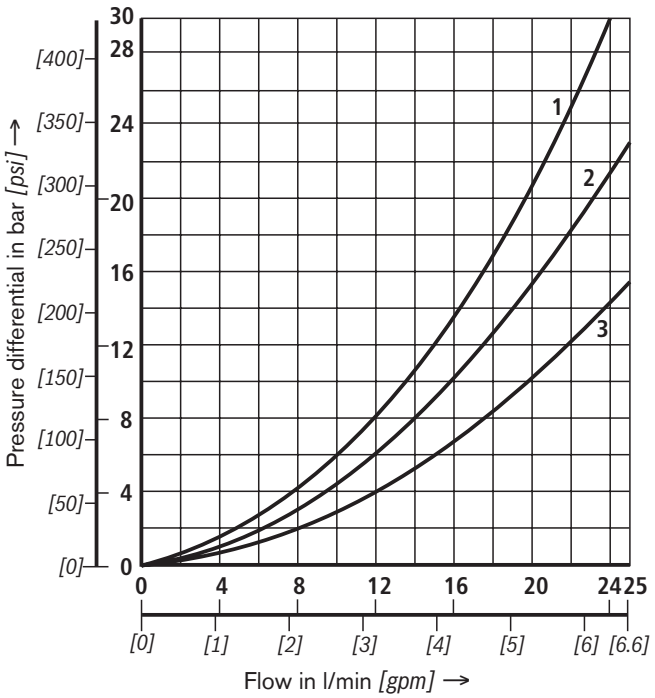
Δp-q_V characteristic curves
2/2 and 3/2 directional poppet valve



1 M-2SED 6 **PK** / **NK** …, P nach A

1 M-3SED 6 **UK** / **CK** …, P to A and A to T

Δp-q_V characteristic curves
4/2 directional poppet valve

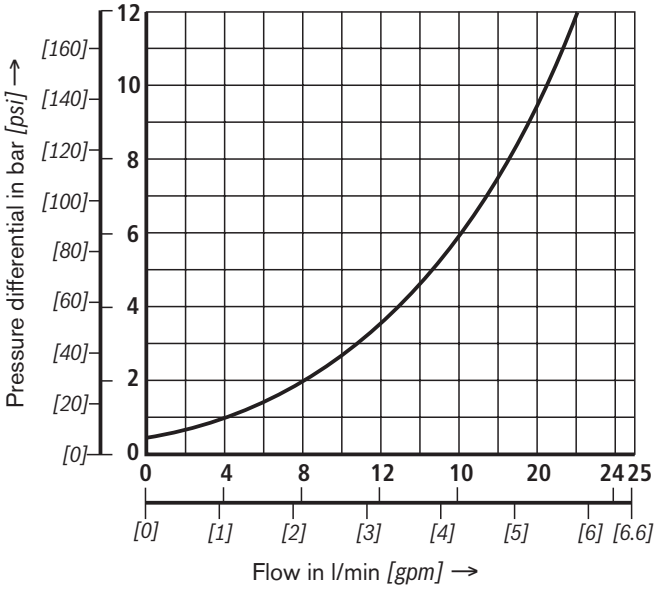


1 M-4SED 6 **D** / **Y** …, A to T

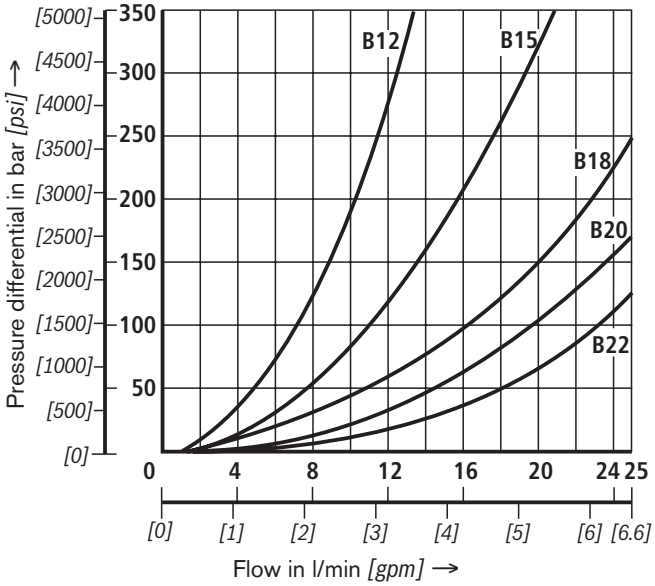
2 M-4SED 6 **D** / **Y** …, P to A

3 M-4SED 6 **D** / **Y** …, B to T and P to B

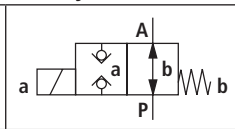
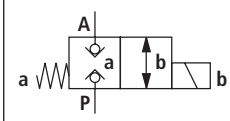
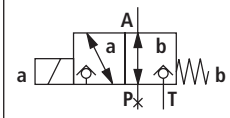
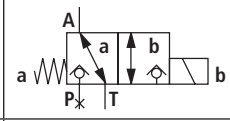
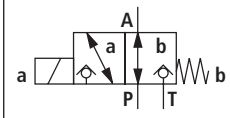
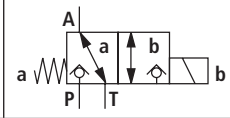
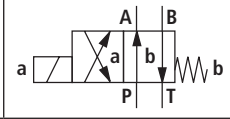
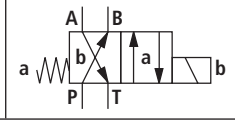
Δp-q_V characteristic curves
Check valve insert



Δp-q_V characteristic curves
Throttle orifice inserts



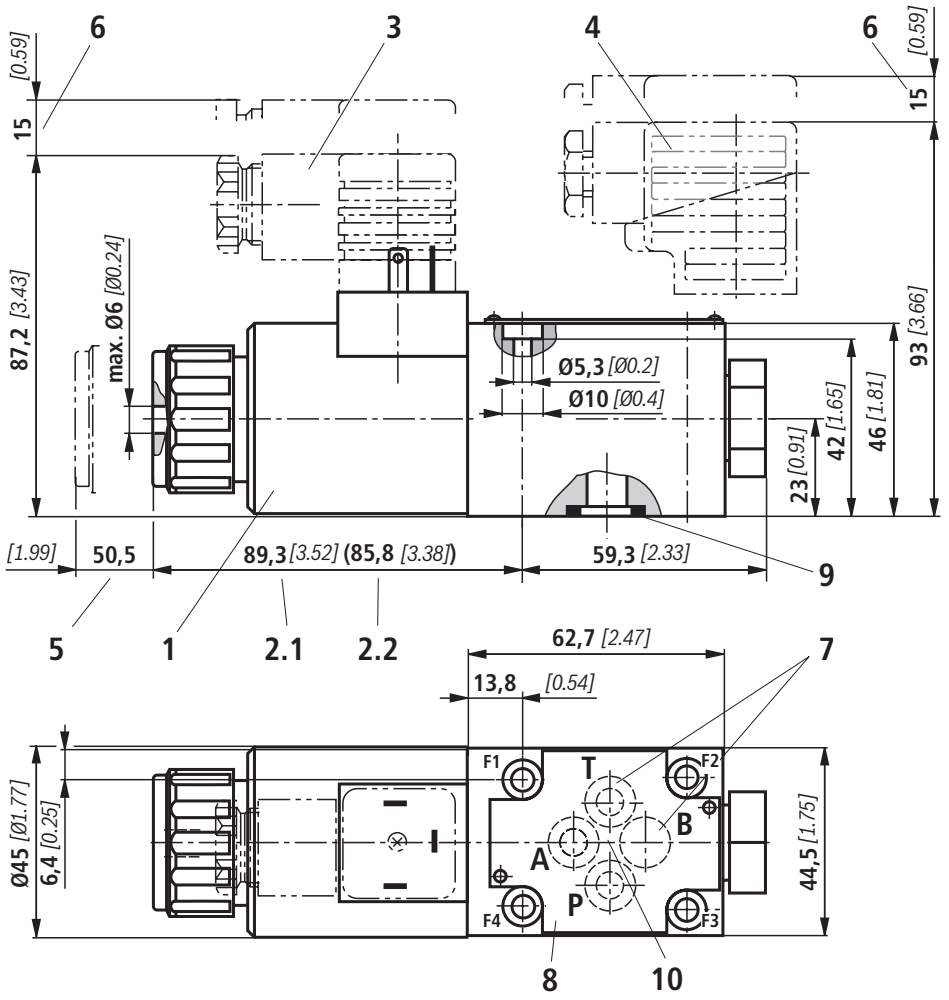
Power limits (measured with HLP46, $\vartheta_{oil\ (\nu = 190\ SUS)} = 40\ °C \pm 5\ °C$ *[104 °F ± 9 °F]*)

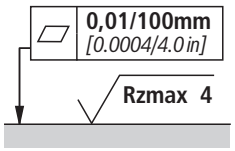
	Symbol		Remark	Operating pressure in bar *[psi]* P	A	B	T	Flow in l/min *[gpm]*
2-way circuit (2/2 directional poppet valve)	**PK**			350 *[5,100]*	350 *[5,100]*			25 *[6.6]*
	NK			350 *[5,100]*	350 *[5,100]*			25 *[6.6]*
2-way circuit (3/2 directional poppet valve)	**UK**		In the case of a 2/2 directional circuit, port P or T must be plugged by the customer!	350 *[5,100]*	350 *[5,100]*		350 *[5,100]*	25 *[6.6]*
	CK			350 *[5,100]*	350 *[5,100]*		350 *[5,100]*	25 *[6.6]*
3-way circuit	**UK**			350 *[5,100]*	350 *[5,100]*		350 *[5,100]*	25 *[6.6]*
	CK			350 *[5,100]*	350 *[5,100]*		350 *[5,100]*	25 *[6.6]*
4-way circuit (flow inly possible in the direction of the arrow!)	**D**		3/2 directional valve (symbol **UK**) in conjunction with Plus-1 plate: $p_P > p_A \geq p_B > p_T$	350 *[5,100]*	350 *[5,100]*	350 *[5,100]*	p_P – 40 *[580]*	25 *[6.6]*
	Y		3/2 directional valve (symbol **CK**) in conjunction with Plus-1 plate: $p_P > p_A \geq p_B > p_T$	350 *[5,100]*	350 *[5,100]*	350 *[5,100]*	p_P – 40 *[580]*	25 *[6.6]*

⚠ **Caution!**

The power limits were determined with the solenoids was at operating temperature, at 10 % undervoltage and with the tank not pressurized.

Dimensions: 2/2 directional poppet valve (**PK**) and 3/2 directional poppet valve (**UK**) (nominal dimensions in mm *[inch]*)





Required surface quality of the mating piece

1 Solenoid **a** (ANSI coil designation see RE 08010)

2.1 Dimension of valve with concealed manual override **N9** – the manual override can only be operated at tank pressures up to approx. 50 bar *[725 psi]*. Use tool R900024923 to prevent damage to override!

2.2 Dimension of valve without manual override

3 Mating connector **without** circuitry (order separately, see page 12)

4 Mating connector **with** circuitry (order separately, see page 12)

5 Space required to remove coil

6 Space required to remove mating connector

7 ⚠ **Caution!**
On 2/2 and 3/2 directional poppet valves, port B is provided only as a blind bore. On 2/2 directional poppet valves, port T is blocked internally.

8 Nameplate

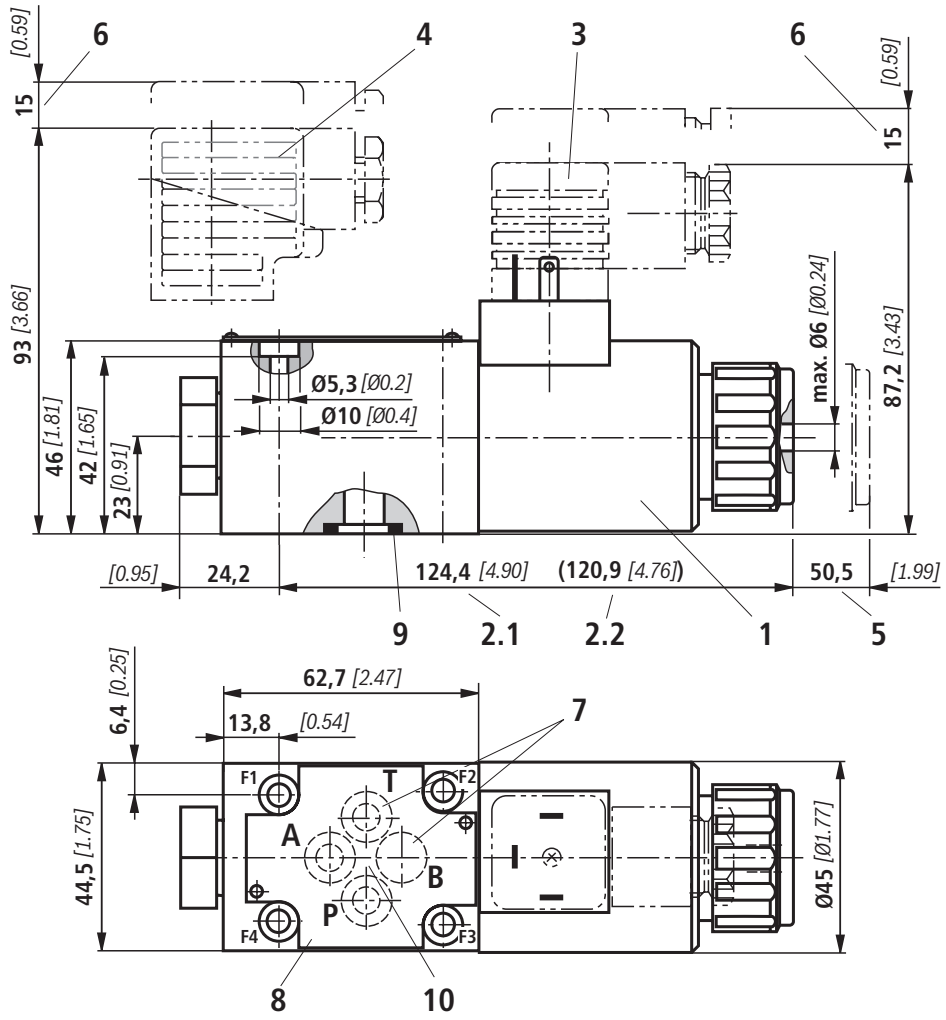
9 Identical seal rings for ports A, B, P and T

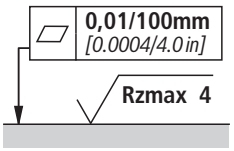
10 Port pattern as per DIN 24340 form A (**without** locating bore), or ISO 4401-03-02-0-94, NFPA T3.5.1 MR1 and ANSI B93-7 D03 interface (**with** locating bore for anti-rotation pin ISO 8752-3x8-St, material number **R900005694**, included in the scope of supply)

Subplates see data sheet RE 45052

Valve mounting bolts see page 12.

Dimensions: 2/2 directional poppet valve (**NK**) and 3/2 directional poppet valve (**CK**) (nominal dimensions in mm *[inch]*)





Required surface quality of the mating piece

1 Solenoid **b** (ANSI coil designation see RE 08010)

2.1 Dimension of valve with concealed manual override **N9** – the manual override can only be operated at tank pressures up to approx. 50 bar *[725 psi]*. Use tool R900024923 to prevent damage to override!

2.2 Dimension of valve without manual override

3 Mating connector **without** circuitry (order separately, see page 13)

4 Mating connector **with** circuitry (order separately, see page 13)

5 Space required to remove coil

6 Space required to remove mating connector

7 ⚠ **Caution!**
On 2/2 and 3/2 directional poppet valves, port B is provided only as a blind bore. On 2/2 directional poppet valves, port T is blocked internally.

8 Nameplate

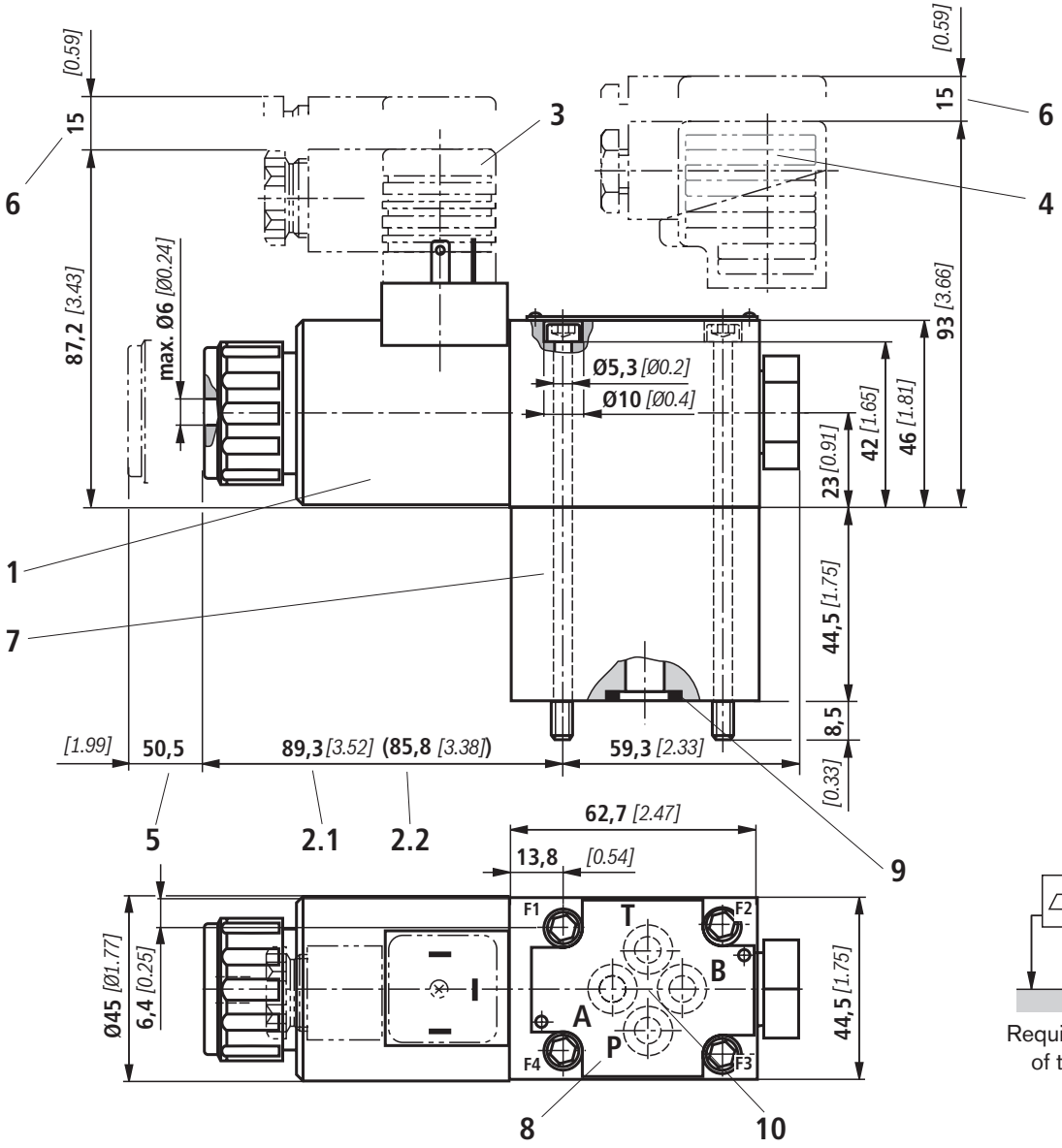
9 Identical seal rings for ports A, B, P and T

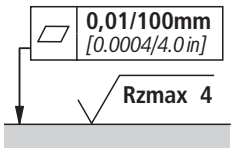
10 Port pattern as per DIN 24340 form A (**without** locating bore), or ISO 4401-03-02-0-94, NFPA T3.5.1 MR1 and ANSI B93-7 D03 interface (**with** locating bore for anti-rotation pin ISO 8752-3x8-St, material number **R900005694**, included in the scope of supply)

Subplates see data sheet RE 45052

Valve mounting bolts see page 13.

Dimensions: 4/2 directional poppet valve (**D**) (nominal dimensions in mm *[inch]*)





Required surface quality of the mating piece

1 Solenoid **a** (ANSI coil designation see RE 08010)

2.1 Dimension of valve with concealed manual override **N9** – the manual override can only be operated at tank pressures up to approx. 50 bar *[725 psi]*. Use tool R900024923 to prevent damage to override!

2.2 Dimension of valve without manual override

3 Mating connector **without** circuitry (order separately, see page 13)

4 Mating connector **with** circuitry (order separately, see page 13)

5 Space required to remove coil

6 Space required to remove mating connector

7 Plus-1 plate

8 Nameplate

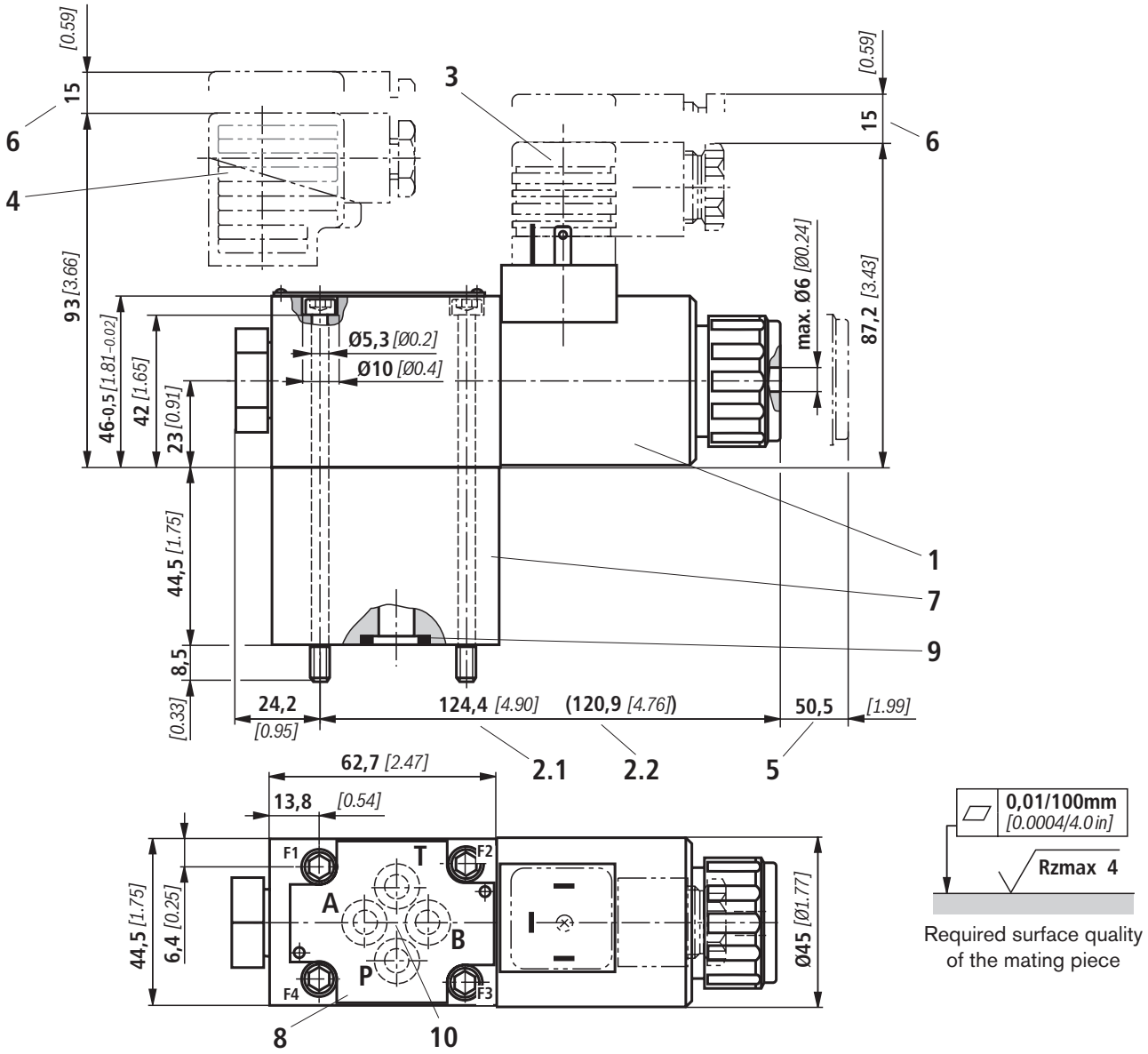
9 Identical seal rings for ports A, B, P and T

10 Port pattern as per DIN 24340 form A (**without** locating bore), or ISO 4401-03-02-0-94, NFPA T3.5.1 MR1 and ANSI B93-7 D03 interface (**with** locating bore for anti-rotation pin ISO 8752-3x8-St, material number **R900005694**, included in the scope of supply)

Subplates see data sheet RE 45052

Valve mounting bolts see page 13.

Dimensions: 4/2 directional poppet valve (**Y**) (nominal dimensions in mm *[inch]*)



Required surface quality of the mating piece

1 Solenoid **b** (ANSI coil designation see RE 08010)

2.1 Dimension of valve with concealed manual override **N9** – the manual override can only be operated at tank pressures up to approx. 50 bar *[725 psi]*. Use tool R900024923 to prevent damage to override!

2.2 Dimension of valve without manual override

3 Mating connector **without** circuitry (order separately, see page 13)

4 Mating connector **with** circuitry (order separately, see page 13)

5 Space required to remove coil

6 Space required to remove mating connector

7 Plus-1 plate

8 Nameplate

9 Identical seal rings for ports A, B, P and T

10 Port pattern as per DIN 24340 form A (**without** locating bore), or ISO 4401-03-02-0-94, NFPA T3.5.1 MR1 and ANSI B93-7 D03 interface (**with** locating bore for anti-rotation pin ISO 8752-3x8-St, material number **R900005694**, included in the scope of supply)

Subplates see data sheet RE 45052

Valve mounting bolts see page 13.

Valve mounting bolts

2/2 and 3/2 directional poppet valve

4 socket head cap screws (SHCS) metric
ISO 4762 - M5 x 50 - 10.9-flZn-240h-L (order separately)
(friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 7 Nm *[5.2 ft-lbs]* ± 10%,
material number **R913000064**
or
4 socket head cap screws (SHCS)
ISO 4762 - M5 x 50 - 10.9 (self procurement)
(friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 8.1 Nm *[6 ft-lbs]* ± 10%

4 socket head cap screws (SHCS) UNC
10-24 UNC x 2" (self procurement)
(friction coefficient μ_{total} = 0.19 to 0.24 as per ASTM-574);
tightening torque M_T = 11 Nm *[8.1 ft-lbs]* ± 10%,
(friction coefficient μ_{total} = 0.12 to 0.17 as per ISO 4762);
tightening torque M_T = 8 Nm *[5.9 ft-lbs]* ± 10%,
material number **R978833365**

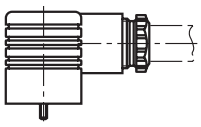
4/2 directional poppet valve

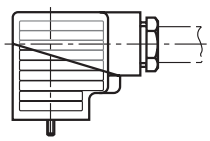
4 socket head cap screws (SHCS) metric
ISO 4762 - M5 x 95 - 10.9-flZn-240h-L (included in the scope of supply) (friction coefficient μ_{total} = 0.09 to 0.14);
tightening torque M_T = 7 Nm *[5.2 ft-lbs]* ± 10%,
material number **R913000223**
or
4 socket head cap screws (SHCS)
ISO 4762 - M5 x 95 - 10.9 (self procurement)
(friction coefficient μ_{total} = 0.12 to 0.17);
tightening torque M_T = 8.1 Nm *[6 ft-lbs]* ± 10%

4 socket head cap screws (SHCS) UNC
10-24 UNC x 3 3/4" (self procurement)
(friction coefficient μ_{total} = 0.19 to 0.24 as per ASTM-574);
tightening torque M_T = 11 Nm *[8.1 ft-lbs]* ± 10%,
(friction coefficient μ_{total} = 0.12 to 0.17 as per ISO 4762);
tightening torque M_T = 8 Nm *[5.9 ft-lbs]* ± 10%,
material number **R978881682**

Mating connector (DIN EN 175301-803)

For details and additional mating connectors, see RE 08006





Cable gland	Valve side	Color	Material Numbers: Without circuitry	With LED lamp 12 … 240 V	With rectifier 12 … 240 V	With LED lamp and Zener diode suppressor circuit 24 V
M16 x 1,5	a	grey	**R901017010**	–	–	–
	b	black	**R901017011**	–	–	–
	a/b	black	–	**R901017022**	**R901017025**	**R901017026**
1/2" NPT (Pg16)	a	red/brown	**R900004823**	–	–	–
	b	black	**R900011039**	–	–	–
	a/b	black	–	**R900057453**	**R900842566**	–

Throttle orifice insert

The use of the throttle insert is required, if, due to the given operating conditions, flows can occur during the switching processes, which exceed the power limit of the valve.

Example:

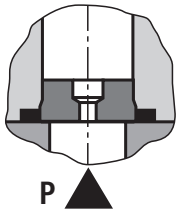
– Accumulator operation,
– Use as pilot control valve with internal pilot oil tapping.

2/2 and 3/2 directional poppet valve

The throttle insert is to be installed in port P of the poppet valve.

4/2 directional poppet valve

The throttle insert is to be installed in port P of the Plus-1 plate.



Check valve insert

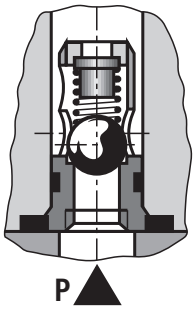
The check valve insert allows a free fluid flow from P to A and leak-free blockage of flow from A to P.

2/2 and 3/2 directional poppet valve

The check valve insert is to be installed in port P of the poppet valve.

4/2 directional poppet valve

The check valve insert is to be installed in port P of the Plus-1 plate.



General notes

Poppet valves must be used in accordance with the spool symbols and the specified operating pressures and flows (see performance limit on page 7).

To ensure their reliable operation, the following points must be strictly observed:

– In order to operate the valve safely and maintain the switched position, the pressure in p_P must be ≥ p_A ≥ p_T (for design reasons).
– Poppet valves feature a negative overlap, i.e. during the switching process, P-A-B leakage occurs. But this process is completed within such a short time that it is irrelevant in almost any application.
– The specified maximum flow must not be exceeded (if required, use a throttle insert to limit the flow)!

Plus-1 plate:

– When using the Plus-1 plate (4/2 directional function), the following lower operating values must be taken into account: $p_{min} = 8$ bar; $q_V > 3$ l/min.
– Ports P, A, B and T are strictly designated and assigned. They must not be interchanged nor plugged!
– Port T must always be connected in the case of a 3- and 4-way operation.
– Take note of the pressure level and pressure distribution!
– Flow is only permitted in the direction of the arrow!

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Notes

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